Jennifer Spegon
US Fish & Wildlife Service R7
Regional Energy Coordinator
1011 E. Tudor Road
Anchorage, AK 99503

Dear Ms. Spegon,

The USGS Alaska Area has reviewed the document "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska" recently produced by the Environmental Protection Agency. We offer the following comments on the report.

Within the draft document itself, descriptions and projections often refer directly to the need for scientific baseline data. It would be beneficial to reviewers if the types and dates of baseline data collected and used for the assessment were listed in an appendix. For example: Appendix B refers to "key" fish habitat conditions that include elevation, slope and groundwater, and yet data for none of these are presented; similar for Appendix C and wildlife distributions. Also, the assessment of projected scenarios (e.g. evaluation of road impact, pipeline failure etc.) require information on parameters such as permafrost distribution, slope aspect, surficial materials stability etc., and yet these scientific data are nowhere presented, cited or referenced in this document.

Executive Summary, p. 2., "The geographic scope of the assessment is the Nushagak River and Kvichak River watersheds. These….compose about 50% of the total (Bristol Bay) watershed area." Appendices A, B, E, F, and G however, discuss the entire Bristol Bay watershed, including economic analysis, without identifying the portions of those chapters, costs, values and effects which actually lie within the Nushagak/Kvichak watersheds.

Section 4 and Appendix I (on water quality mitigation) refer to the non-acid generating vs. acid-generating potential of overburden and waste rock as critical controls on mitigation practices for any proposed development. Yet nowhere does this assessment document present, or cite or refer to any existing mineralogic or analytical geochemical data on material properties from the actual Nushagak or Kvichak watersheds. Also in Appendix I, p. 10, refers to "ore from Zn, Cu or Pb sulfide porphyry deposits." There is no such thing as a Zn porphyry or Pb porphyry deposit.

Page 4-38, second full paragraph, 7th line - the report states, the USGS has concluded there is no evidence for movement on the Lake Clark Fault "in the past 1.8 million years." The text in quotes should be replaced with "since the last glaciation around 11,000 to 13,000 years ago." This error has been propagated despite earlier attempts at having it corrected. The USGS has never taken the position as stated in the report.

Page 4-38, third full paragraph - end - There has been lots of discussion about the location of the Lake Clark fault. In the end, the position of the fault does not matter as much as the question of whether or not the fault is active. One could spend a lot of time and effort to locate the fault, but if it is not an active fault, it does not matter for seismic hazards.

Page 4-48, Box 4-6. From a geological and hazards perspective, the tailings dam should be designed to withstand shaking from the "Maximum Credible Earthquake" or MCE. The mine will be in operation a relatively short period of time, but the tailings dam will be there *in perpetuity*. If the regulatory desire is for contaminants to not escape the tailings dam, the seismic hazard will exist as long as the dam is in place. A related issue is that the MCE is established by consensus of knowledgeable scientists. This MCE is also subject to interpretation and it would be appropriate for the EPA to include the best scientists in this decision making process. A related topic is whether the EPA needs to have a concrete or legal definition of an active fault. In California, the legal definition is one that has been active or shows movement in the last 10,000 years. Although perhaps an arbitrary figure, in many regions of Alaska we can determine if a fault has moved since the last glaciation, which is slightly longer than 10,000 years. For this report, we suggest that an active fault be defined as "one that has moved in either the last 10,000 years or since the last glacial maximum around 11-13,000 years ago, whichever time frame is more practical to determine."

Page 4-48, Box 4-6 bottom paragraph - The ground accelerations listed during various magnitude earthquakes are likely global averages for earthquakes of a given magnitude; however, there are common examples of ground accelerations exceeding such values. For example, the relatively small 1994 Northridge earthquake in the Los Angeles area had a moment magnitude of 6.7, but ground accelerations measured 1.7g. Design criterion should take into account the possibility of high ground accelerations that exceed average accelerations for a facility that needs to remain intact in perpetuity. Also, the source of the listed ground accelerations should be cited.

Page 4-38, line 5 - "length of the fault". The size of an earthquake is directly related to the <u>area</u> of the fault that ruptures—not just the length of the fault

Page 4-38, line 9 and following to the end of the paragraph - These are the largest strike slip fault systems in the region, but not all of them are known to be seismically active. It is implied that they are. The Border Ranges Fault, the Lake Clark fault, the Iditarod-Nixon Fork faults are not known to be active.

Page 4-38, paragraph 3 - This discussion about the location of the Lake Clark fault is irrelevant if the Lake Clark fault is not active. Right now, there is no evidence for activity. Additional work could be done to assess if the fault is active, such as looking for the fault using airborne lidar, and looking for the fault beneath Lake Clark with multibeam bathymetry and seismic profiling.

Page 4-39 last sentence - geologic studies can also provide information on the rate of fault movement as well. Please include this in the list. It is important for seismic hazards as to whether faults are moving quickly or slowly. Also suggest deleting "many" before "uncertainties" at the end of the sentence.

Page 4-43, Box 4-5, 2nd to last paragraph - this earthquake is known as the "Denali Fault earthquake", not the "Denali earthquake" as written.

Page 4-44, Table 4-7 - The depth of these earthquakes, not just distance is also very important. It

should to be added to the table. There should also be a label with the type of earthquake. Examples: 1964 - megathrust earthquake; 2002 - Denali fault earthquake; 1985 - "crustal earthquake" or "Benioff zone earthquake" -- use whatever label is appropriate.

Page 4-44, last sentence - "....overtopping" - of what? It's not clear and may be important as to the overall effect of earthquakes.

If you would like more information on the comments, please contact me at 907 786 7023.

Sincerely,

Carl Markon
Deputy Regional Executive, USGS - Alaska Area